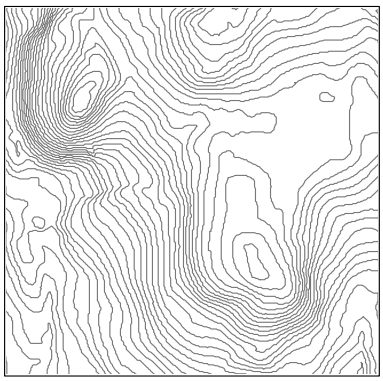
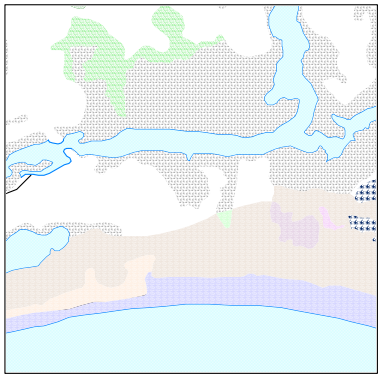


MassGIS DATALAYER DESCRIPTIONS and GUIDE TO USER SERVICES



July 2001

MassGIS
251 Causeway St., Suite 900
Boston, MA 02114

***M** assachusetts*
Geographic Information System
Commonwealth of Massachusetts Executive Office of Environmental Affairs

MassGIS is the Commonwealth's Office of Geographic and Environmental Information

MassGIS DATALAYER DESCRIPTIONS and GUIDE TO USER SERVICES

July 2001

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REFERENCE LISTS

INDEX MAPS

MassGIS has new contact information (as of November 2000):

Mailing Address:
MassGIS
251 Causeway Street, Suite 500
Boston, MA 02114

Phone: (617) 626-1000
Fax: (617) 626-1249

See page 3 for full staff list

MassGIS is located on the 5th floor, but our mailing address is as listed above.

Catalog edited by Michael Trust

Content written 1990-2001.
Contributors include Anita Beinikis, Jim Brown, Katie Busse, Diane Carle, Gretchen Eliason, Aleda Freeman, David Freidenfeld, Mark Goodwin, Dorothy Graaskamp, Robert Hames, Barbara Hopson, Christian Jacqz, Daniel Martin, Carl Nylen, Dominique Pahlavan, John Rader, Tara Manno Richer, Aaron Richer, Liz Sorenson, Michael Steinitz, David Szczebak, Julie Sweitzer, Michael Trust

HOW TO USE THIS GUIDE

This catalog describes the products and services available from MassGIS. It is divided into two major sections. Section 1 provides a brief definition of GIS, the history and mission of MassGIS, and a list of additional sources of GIS information and data. Section 1 also describes the data and map ordering process and data development services available from MassGIS, including the MassGIS Data Viewer. Ongoing data development projects are also described. Section 1 also contains an overview of the ARC/INFO "Librarian" data storage format used by MassGIS, and a complete description of the MassGIS Data Standard for documentation of data (metadata).

The bulk of the catalog, Section 2, contains descriptions of the MassGIS data ("datalayers"). For each datalayer available from the Executive Office of Environmental Affair's (EOEA) geographic database, detailed descriptions of data sources, scale, production techniques, and database attributes are provided. Following this section are reference lists and index maps that are helpful when using and ordering maps and data.

This catalog is a handy reference to have available when working with MassGIS data. The information contained in this Guide is also maintained on the MassGIS Web site: http://www.state.ma.us/mgis.

MassGIS ON THE WEB

Check our Web site for the most recent developments at MassGIS and additional resources:

- MassGIS makes available all its data online, free of charge. Just click on the "Download Free Data" link on the home page.
- Order paper maps and digital data on CD-ROM, including the MassGIS Data Viewer. Just click on the "Order Maps and CDs" link on the home page.
- Browse data using one of several online mapping viewers, including Digital Orthophotos, USGS Quadrangle maps, and Protected Open Space. Choose the "Online Mapping" link for details.

http://www.state.ma.us/mgis

MassGIS PRODUCTS AND SERVICES

What is GIS?

A Geographic Information System (GIS) is a computer system capable of assembling, storing, manipulating, and displaying geographically referenced information (i.e. spatial data). This system should include:

- Hardware (computers, printers, plotters, scanners, digitizers, GPS units, etc.)
- Software (programs like ArcInfo, ArcView, MapInfo, Maptitude, AutoCad Map, GeoMedia, etc.)
- Data (files that may be loaded into the software programs, such as roads, town boundaries, parcels, aerial photographs, etc.)
- Staff (analysts, technicians, etc.)

Geographic information systems belong to a family of mapping and drafting programs that includes computer-aided design (CAD) and automated mapping and facilities management (AM/FM). GIS is distinguished from CAD and AM/FM by its capacity to perform complicated analytical functions that often include combining information from different sources to derive meaningful relationships.

The Web has a vast amount of resources relating to GIS. For more general information on GIS you may want to visit the following sites:

- http://info.er.usgs.gov/research/gis/title.html - **Introduction to GIS** from the U.S. Geological Survey
- http://www.census.gov/ftp/pub/geo/www/faq-index.html - A list of **frequently asked questions** (and their answers!) on GIS, from the U.S. Census Bureau
- http://www.umass.edu/masscptc/gis.html - **Introduction to GIS** from the Massachusetts Citizen Planner Training Collaborative at UMass Amherst
- http://www.geo.ed.ac.uk/agidict/welcome.html - **GIS Dictionary**, from the Association for Geographic Information
- news:comp.infosystems.gis is a Usenet resource (newsgroup) to which anyone with an interest in GIS may post questions

What is MassGIS?

MassGIS is the Commonwealth's Office of Geographic and Environmental Information, within the state's Executive Office of Environmental Affairs. Through MassGIS, the Commonwealth of Massachusetts has created a comprehensive, statewide database of spatial information for environmental planning and management. Recent legislation has established MassGIS as the official state agency assigned to the collection, storage and dissemination of geographic data. The legislation gives MassGIS the mandate to:

- Collect, consolidate, store and provide geographic and environmental information in order to improve stewardship of natural resources and the environment, promote economic development and guide land-use planning, risk assessment, emergency response and pollution control
- Expand library of GIS and related environmental information and provide access to that library
- Foster cooperative data development and data sharing
- Set standards for the acquisition and management of geographical and environmental data by any agency, authority or other political subdivision of the Commonwealth
- Provide technical support to municipalities and regional agencies
- Establish regional service centers
- Establish statewide advisory board
- Coordinate scientific and technical expertise

The evolution of Geographic Information Systems in the Commonwealth is not unlike its development in other states. A lead agency, in this case the Executive Office of Environmental Affairs (EOEA), perceived an opportunity to meet its goals through development of a statewide GIS. Three related feasibility studies were funded, a plan for development was negotiated with EOEA's agencies, and that plan was implemented

over a five-year period, creating the Massachusetts Geographic Information System - MassGIS - in the late 1980s. As a result, EOEA has become a leading provider of digital geographic information within the Commonwealth and among Massachusetts public agencies using geographic information technology.

EOEA is a cabinet level office that coordinates five environmental and natural resource departments:

- Department of Environmental Management (DEM)
- Department of Environmental Protection (DEP)
- Department of Fisheries, Wildlife, and Environmental Law Enforcement (DFWELE)
- Department of Food and Agriculture (DFA)
- Metropolitan District Commission (MDC)

Besides MassGIS, other offices within EOEA include:

- Massachusetts Environmental Policy Act (MEPA)
- Massachusetts Coastal Zone Management Office (MCZM)
- Office of Technical Assistance (OTA)
- Division of Conservation Services (DCS)
- Massachusetts Environmental Trust

MassGIS now has close to sixty users within EOEA who have direct access to the system software and as many as twenty projects in progress at any given time. MassGIS staff operates ARC/INFO and ArcView GIS software on DEC Alpha, Sun, and Windows NT and 2000 computer systems, maintains color inkjet large-format plotters, two color LaserJet small-format printers, and a large-format drum scanner. MassGIS distributes data from its database to municipalities, schools, non-profit programs, and the general public in the form of paper maps and CD products, as well as via free download from its Web site.

Contacts/Where to turn for more information

MassGIS

Main Phone: (617) 626-1000 **Fax: (617) 626-1249**
EOEA - MassGIS
251 Causeway St., Suite 900
Boston, MA 02114

Map and Data Orders (status and information):
- *Dan Marrier 626-1237* daniel.marrier@state.ma.us

MassGIS Assistant Director:
- *Neil MacGaffey 626-1057* neil.macgaffey@state.ma.us

GIS Database, Orthophotos and Website:
- *Michael Trust 626-1195* michael.trust@state.ma.us

MassGIS Data Viewer:
- *Aleda Freeman 626-1193* aleda.freeman@state.ma.us

Community Preservation Initiative Coordinator:
- *Jane Pfister 626-1194* jane.pfister@state.ma.us

Massachusetts Watershed Initiative:
- *Dominique Pahlavan 626-1184* dominique.pahlavan@state.ma.us

Open Space Mapping Project:
- *Scott Costello 626-1076* scott.costello@state.ma.us

Global Positioning System (GPS) sign-out/Scanning services:
- *Philip John 626-1185* philip.john@state.ma.us

GIS In The Classroom:
- *Paul Nutting 626-1238* paul.nutting@state.ma.us

System Administrator:
- *Gregory Mandryk 626-1186* gregory.mandryk@state.ma.us

MassGIS Director:
- *Christian Jacqz 626-1056* christian.jacqz@state.ma.us

GIS at Other State Agencies

Central Transportation Planning Staff: 617-973-7077
Coastal Zone Management: 617-626-1222
Department of Environmental Management: 617-626-1381
Department of Environmental Protection: 617-292-5675
Department of Fisheries, Wildlife and Environmental Law Enforcement: 617-626-1592
Department of Food and Agriculture: 508-792-7712
Department of Housing and Community Development: 617-727-7001 x 443
Executive Office of Transportation and Construction: 617-973-8239
Massachusetts Historical Commission: 617-727-8470
Massachusetts Water Resources Authority: 617-241-6346
Metropolitan District Commission:
Division of Watershed Management: 617-727-5274 x288
Metro Parks: 617-727-5264 x661

Massachusetts Geographic Information Council (MGIC)

The Massachusetts Geographic Information Council (MGIC, pronounced "magic") is an informal organization of GIS professionals from Federal, state, regional, and local government, public and private utilities, educational institutions, and businesses. The Council organizes monthly user meetings featuring presentations on GIS and related topics. Participation in MGIC is open to all. For more information contact MassGIS at (617) 626-1057, or the Information Technology Division (ITD) at (617) 973-0865. MGIC. See http://www.state.ma.us/mgis/mgic_ix.htm.

Regional Planning Authorities

Regional planning authorities provide data and other services to their member communities.

Berkshire Regional Planning Commission: 413-442-1521
Cape Cod Commission: 508-362-3828
Central Massachusetts Regional Planning Commission: 508-756-7717
Franklin Regional Council of Governments: 413-774-3167
Martha's Vineyard Commission: 508-693-3453
Merrimack Valley Planning Commission: 978-374-0519
Metropolitan Area Planning Council: 617-451-2770
Montachusett Regional Planning Commission: 978-345-7376
Nantucket Planning and Economic Development Commission: 508-228-7237
Northern Middlesex Council of Governments: 978-454-8021
Old Colony Planning Council: 508-583-1833
Pioneer Valley Planning Commission: 413-781-6045
Southeastern Regional Planning and Economic Development District: 508-824-1367

Other Regional GIS Programs

Essex County Registry of Deeds: 978-741-0201 x217

New England State GIS Programs - In addition to Massachusetts, all other New England states maintain a state GIS office. For information on data services in other New England states call:

Connecticut GIS: 203-424-3540
Maine Office of GIS: 207-287-3897
New Hampshire GRANIT: 603-271-2155
Rhode Island GIS (RIGIS): 401-222-6483
Vermont Center for Geographic Information (VCGI): 802-656-4277

In addition to the sources listed above, there are a number of professional organizations and publications that provide information on GIS and related topics. Contact MassGIS for more information or visit http://www.state.ma.us/mgis/resources.htm.

Data and Map Ordering Services

MassGIS offers digital data distribution and map production services. These services are available to both the public and private sectors. Maps can be purchased by submitting an order form online or via fax or mail. Digital GIS data can be obtained free by download from this site or purchased by submitting an order online or via fax or mail. In addition, non-profit, government, and educational organizations may receive digital data through our grant or data exchange programs.

Map Production and Printing

Overview of Map Products

MassGIS maintains color Hewlett-Packard inkjet plotters to produce maps from the EOEA geographic database. MassGIS has prepared a number of Map "Themes" (see section below) to facilitate distribution of frequently requested GIS data in the form of maps. All maps are prepared when ordered and display the most current data. MassGIS does not produce custom maps. Map products include:

DEP MCP 21e Site Maps:

- Cost: $25.00 for the first sheet, $5.00 for additional copies of the same map.
- Size: 8" x 11", printed on an HP color Laserjet 4500.
- Scale: 1:15,000
- When ordering, you must provide UTM, Latitude-Longitude, or Mass. Stateplane coordinates for the site you wish to have mapped. No site maps can be produced without coordinates.

Standard Large Format Maps

- Cost: $25.00 for the first sheet, $5.00 for additional copies of the same map.
- Maximum size: 33" x 46" (based on area mapped), printed on an HP 755 or HP 3500 plotter
- Scale: 1:25,000 for most maps (large areas may be plotted at smaller scales)
- When ordering, you pick the area you would like mapped (i.e. "towns of Cohasset & Scituate).
- Themes available are listed below.

Shoreline Change Maps:

- Cost: $20.00 per map sheet.
- Size: 33" x 46", printed on an HP 755 plotter.
- Maps may be ordered according to the Shoreline Change Index (at back of catalog).

Wetlands atop Orthophoto Maps:

- Cost: $15.00 per map at 1:5,000 scale; $10.00 for map at 1:10,000 scale.
- Size: 33" x 43", printed on an HP 755 color plotter.

All large format maps are printed on white, HP Coated paper. Printing on mylar or other media is not supported. Site Maps are usually run on Tuesdays and are mailed by U.S. Mail on Wednesdays. You may indicate on the order form that you would like to pick up your map(s)in person or have them shipped by an overnight courier.

How to Order Maps

Submit a request for any map via

- the Online Order Form at http://www.state.ma.us/mgis/order.htm
- the Order Form for maps at the end of this section

Fax it to **(617) 626-1249**, or mail to: **EOEA - MassGIS**
Attn: Map Request
251 Causeway St., Suite 900
Boston, MA 02114

Note: This is a new address and fax for MassGIS (as of Nov. 2000)

Payment

If an order is placed online or by fax, or if a mail request does not include payment, an invoice for total fees will be included with your order. Payment is to be made via check or money order made out to the Executive Office of Environmental Affairs. We do not accept cash or credit cards.

Note about Charges: The Massachusetts Legislature established a schedule of fees to be charged by EOEA for digital data and cartographic services under the Budget Control and Reform Act of 1989 (Ch.653, §138). Each product is placed in a price category according to the complexity of the data or service. The charges are intended to recover the costs of labor, materials, and computer processing time expended in fulfilling requests.

Map "Themes" Available for Printing

DEP MCP (21E) Numerical Ranking System (Site or Large-format)

Displays all environmental data suitable for a Massachusetts Contingency Plan (MCP or Chapter 21E) site assessment as required by the Department of Environmental Protection, including Potentially Productive Aquifers, Non-potential Drinking Water Source Areas (shown by high and medium yield), Sole Source Aquifers, Public Water Supplies, Zone IIs, Interim Wellhead Protection Areas, Wetlands, Protected Open Space, Areas of Critical Environmental Concern, DEP Permitted Solid Waste Facilities, NHESP Habitats and Certified Vernal Pools, and base map features. Site maps are 8½" x 11" in size, printed at 1:15,000 scale and include 500' and 1/2 mile radii around client-specified coordinates. Quads and most municipalities are printed at 1:25,000 scale.

Current Land Use

Displays in color all twenty-one categories from the Current Land Use datalayer and base map features. Data is suitable for use at 1:25,000 scale or smaller; however, at *much* smaller scales, this data may become undistinguishable.

Protected Open Space

Displays Protected and Recreational Open Space parcels compiled by the Open Space Mapping Project with base map features. Parcels are color-coded to indicate by which public, private or non-profit agency they are owned. This theme will display the most recent data verified by the Open Space Project as of the date of printing.

Protected Open Space/Water Resources

Displays Protected and Recreational Open Space parcels compiled by the Open Space Mapping Project with Aquifers (high- and medium-yield), Zone IIs, Interim Wellhead Protection Areas, Areas of Critical Environmental Concern, wetlands, Public Water Supplies and base map features.

Title 5

Displays areas affected by Title 5 regulations, including estimated setbacks, water resources (drainage basins, Zone IIs, IWPAs, hydrography, wetlands, NHESP Vernal Pools and Public Water Supplies), ACECs, DEP Permitted Solid Waste Facilities and base map features. Detailed data sources and guidance notes for map use are included. Available by municipality or quad.

Wetlands Habitats

Displays Estimated Habitats of State-listed Rare Wetlands Wildlife and Certified Vernal Pools, Open Space, wetlands and base map features. Produced by the Natural Heritage and Endangered Species Program for use with the Wetlands Protection Act Regulations only. Available by town.

Surficial Geology

Displays 1:250,000 scale surficial geology and base map features. Strictly recommended for regional map extents, this map theme should not be used for site-specific analysis.

Community Water Supply

Displays Aquifers (high- and medium-yield), Drainage Basin and Sub-Basin boundaries, Public Water Supplies (with annotation), DEP-approved Zone IIs, Interim Wellhead Protection Areas, watershed areas (including MDC/MWRA Water Supply Watersheds and Emergency/Backup Water Supply Watersheds), wetlands, hydrography, Open Space, Areas of Critical Environmental Concern, DEP Permitted Solid Waste Facilities, Discharge Points, and base map features.

Outstanding Resource Waters

Displays Outstanding Resource Waters (contributing areas of a public water supply and water bodies within certain parks, wildlife refuges, and ACECs), Solid Waste Landfills, Basin and Sub-Basin boundaries, Public Water Supplies (with annotation), DEP-approved Zone IIs, Interim Wellhead Protection Areas, wetlands, hydrography, NHESP Vernal Pools, and base map features.

Priority Resources

Displays Aquifers (high- and medium-yield, Potential and Non-potential Drinking Water Source Areas, EPA Designated Sole Source), Major and Minor Basin boundaries, Public Water Supplies (annotated), Zone IIs, Interim Wellhead Protection Areas, wetlands and hydrography (scale sensitive), Open Space, Areas of Critical Environmental Concern, NHESP Wetlands Habitats, DEP Permitted Solid Waste Facilities, Surface Water Protection Areas (Zone As) and base map features.

Water Supply Protection

Displays developed lands (high-density residential, commercial, industrial, waste disposal), Aquifers (high- and medium-yield), Drainage Basin and Sub-Basin boundaries, Public Water Supplies (with annotation), DEP-approved Zone IIs, Interim Wellhead Protection Areas, watershed areas, wetlands and hydrography (scale sensitive), and base map features.

Water Supply Protection/Land Use

Displays 21 classifications of current land use, Aquifers (high- and medium-yield), Public Water Supplies (with annotation), DEP-approved Zone IIs, Interim Wellhead Protection Areas, hydrography (scale sensitive), DEP Permitted Solid Waste Facilities, Areas of Critical Environmental Concern, NPDES Discharge Locations, Discharge to Groundwater Permit Locations, and base map features.

Solid Waste Assessment

Displays both the DEP MCP 21E and Land Use themes as 2 separate maps on one page. Includes ½- and 1-mile DEP Permitted Solid Waste Facilities buffers. Available for a municipality or quad.

Solid Waste Facilities and Selected Natural Resources

Displays DEP-approved Zone IIs and Interim Wellhead Protection Areas, public water supply wells and surface water supply intakes, surface waters (no wetlands), medium and high yield aquifers, sole source aquifers, Areas of Environmental Concern, solid waste landfills shaded for status (active, inactive, closed), other solid waste facilities, major basin boundaries, roads, trains and transmission lines. Recommended for regional extents (e.g. DEP Regions, basins, counties).

Shoreline Change

For coastal communities, the Massachusetts Coastal Zone Management (MCZM) office has generated a set of shoreline change maps covering the entire Massachusetts outer (ocean-facing) shoreline, documenting erosion and accretion trends by displaying three to four historic shorelines between the mid-1800s to 1978. The maps, called Historic Shoreline Change Analysis Maps, are printed at a scale of 1:10,000. These maps have the long-term shoreline change rate calculated and printed at 50-meter intervals along the shore. Tables and histograms displaying all short- and long-term shoreline change rates accompany these maps.

DEP Eelgrass Resources

Displays the eelgrass, Zostera marina, resources for the entire state coastline.The eelgrass data was photo-interpreted and extensively field checked during the years 1994 thru 1997. The data is projected onto a NOAA Navigational Chart base that includes coastal features and bathymetry. The maps can be produced at varying scales depending on the area of interest. The maps are available in two sizes: 24x26 in. ($15.00) and 32x38 in. ($20.00).

Wetlands Orthophoto (at 1:5,000 or 1:10,000 scale)

Maps display wetlands features together with hydrological connections as part of Massachusetts Wetlands Inventory atop black and white orthophotography. Features include all open water areas, swamps, marshes, bogs, and dunes, together with coastal systems of tidal flat, rocky shore, beach, and barrier beach environments. Hydrological connections depict both active and intermittent stream courses. 1:5,000 scale maps ($15.00) are tiled by Massachusetts State Plane orthophoto quads and display 1-meter resolution orthophotography, while 1:10,000 scale maps ($20.00) include four orthophoto quads, both in the same 32” by 32” area, with 2-meter resolution orthophotography. The entire 43” by 33” sheet area includes legend, description of wetlands codes and methodology, together with inset map pinpointing location of quad or quads in a larger context of roads and towns
.

Digital Data Products

Overview

The Executive Office of Environmental Affairs (EOEA) has become a leading provider of digital geographic information within the Commonwealth of Massachusetts. Data distribution is the primary service offered to the public by MassGIS. MassGIS distributes sets of data on compact disc covering the entire state or custom orders of data for any geographic area of the state (a town, watershed, etc.). **All data are referenced to the Massachusetts Stateplane Mainland Zone (FIPSZONE 2001) coordinate system, Datum NAD83, units Meters.**

See the Datalayer Descriptions section of this catalog for details on the available datalayers. These data may be divided into two groups, as follows:

Vector data (point, line/arc, area/polygon) are available for distribution in the following formats:

- ARC/INFO Coverages, stored in Librarian ESRI Shapefiles ARC/INFO Export Files (.e00)
- Shapefiles and Export files can be imported into a wide range of GIS software packages including ARC/INFO, ArcView GIS, MapInfo, Maptitude, GeoMedia, and AutoCAD Map, among others. Arc coverages may be loaded directly into ARC/INFO, ArcView, and GeoMedia.

Image data, including orthophotos ans scanned USGS Quadrangle Maps are distributed in these formats:

- TIFF
- MrSID
- BIL (half-meter orthos only)

TIFF images may be used in nearly all software that can display imagery. The MrSID format, which allows high levels of compression with very little loss in quality, is integrated into ArcInfo 8 and may be used in ArcView GIS 3.1 and above by loading the "MrSID Image Support" extension that comes with ArcView. MapInfo 5.0 users may download the free "MrSID Module for MapInfo Professional 5.0" utility from Lizardtech, the maker of the MrSID format. If you'd like to view MrSID images outside of ArcView or MapInfo, you may use the free stand-alone "MrSID Viewer," also available from Lizardtech. For complete descriptions and downloads of these products, visit http://www.lizardtech.com, click on the GIS tab, and then select the "MrSID Viewers" link from the "Products" section in the left-hand margin. Other software vendors are now incorporating support for MrSID into their products.

Standard Data Products

Vector Data	
Item	***Price***
Regional MassGIS Data Viewer - All vector and image data for a particular area of the state (i.e. a town, watershed, etc.), specified by the user, on a single CD *. Includes: • Vector data for all Available Datalayers as ARC/INFO Librarian coverages • Scanned USGS Quad Images • 1:5,000 Black & White Orthophotos • ArcView project file (.apr), complete with legends (.avl files) and other enhancements for easy display of data, for use in ArcView 3.0a, 3.1.1, and 3.2; includes Watershed Analyst and Massachusetts Resource Identification Project tools. • "Runtime" Viewer, a stand-alone, scaled-down version of the ArcView 3.1.1 software for users who do not have any GIS software. • Complete metadata (documentation) Does not include point elevations (sold separately, see below). NHESP layers may be requested specifically on order form. ** If Viewer requires multiple CDs, a charge of $50.00 will be added for each additional CD. Each CD holds a maximum of 650 megabytes of data.*	**$50.00**
Statewide MassGIS Data Viewer - All vector data for the entire state. Multiple-CD set includes: • Vector data in ARC/INFO Librarian coverage format for all Available Datalayers. • ArcView project file (.apr), complete with legends (.avl files) and other enhancements for easy display of data, for use in ArcView 3.0a, 3.1.1, and 3.2. • "Runtime" Viewer, a stand-alone, scaled-down version of the ArcView 3.1.1 software for users who do not have any GIS software. • Complete metadata (documentation) Does not include point elevations (sold separately, see below) or NHESP layers (may be downloaded).	**$100.00**

Statewide Vector Data (ESRI Shapefiles) - All vector data for the entire state. Multiple-CD set includes: • Vector data in ESRI Shapefile format for all Available Datalayers. • Legend files (.avl) for display in ArcView • Complete metadata (documentation) Does not include point elevations (sold separately, see below) or NHESP layers (may be downloaded).	**$100.00**
Statewide Vector Data (Arc Export Files) - All vector data for the entire state. Multiple-CD set includes: • Vector data in ARC/INFO Export file format (.e00) for all Available Datalayers. • Legend files (.avl) for display in ArcView • Complete metadata (documentation) Does not include point elevations (sold separately, see below) or NHESP layers (may be downloaded).	**$100.00**
Point Elevation Data - Point data representing elevations. Multiple-CD set includes: • Elevation data interpreted from 1:5,000 digital orthophotos, for the entire state. • Available as ESRI Shapefiles or ARC/INFO Export Files	**$75.00**
DXF Author – Software utility to convert ARC/INFO coverages and ESRI Shapefiles to DXF files. Details below.	**Free**

Image Data – Orthophotos	
Item	***Price***
Individual 1-meter 1:5,000 Orthophotos (MrSID format) – Digital black and white orthophotos for the entire state. Multiple-CD set includes: • 1600 individual images, one-meter pixel resolution, tiled by the Orthophoto Quad index, • .SDW header files for georeferencing in GIS software • Reference index map showing location of images	**$100.00**
1-meter 1:5,000 Orthophotos (MrSID format) Mosaics – Digital black and white orthophotos for the entire state. 10-CD set includes: • 10 images, 1-meter pixel resolution, each covers a large area of the state, Images some overlap. • .SDW header files for georeferencing in GIS software • Reference index map showing location of images See the Tiling Scheme *Note:* Individual mosaics may be ordered as a custom order at $50 per CD.	**$200.00**
Individual Half-meter 1:5,000 Orthophotos (MrSID format) - Digital black and white orthophotos for the entire state. 10-CD set includes: • 1600 individual images, 1/2-meter pixel resolution, tiled by the Orthophoto Quad index • .SDW header files for georeferencing in GIS software • Reference index map showing location of images	**$200.00**
1-meter Coastal Color Orthophoto (MrSID format) Mosaic - Digital color orthophoto for the entire Massachusetts coastline on a single CD. Includes: • One single image, one-meter pixel resolution, covering the entire coastline, including the Islands • .SDW header files for georeferencing in GIS software	**$50.00**

Image Data – USGS Topographic Maps	
Item	***Price***
Statewide Scanned USGS Quad Images (TIFF format) – Digital versions of all the USGS Topographic maps for Massachusetts. 5-CD set includes: • 1600 individual images, tiled by the Orthophoto Quad index, in TIFF format. Images are "seamless" (all map margins removed) • .TFW header files for georeferencing in GIS software • Reference index map showing location of images • "Runtime" Viewer, a stand-alone, scaled-down version of the ArcView 3.1.1 software for users who do not have any GIS software to allow for easy viewing of the images. ▪ Complete metadata (documentation)	**$100.00**
Statewide Scanned USGS Quad Images (MrSID format) – Digital versions of all the USGS Topographic maps for Massachusetts on one CD. Includes: ▪1600 individual images, tiled by the Orthophoto Quad index, Images are "seamless" (map margins removed) ▪.SDW header files for georeferencing in GIS software ▪Complete metadata (documentation)	**$50.00**
Single Statewide Scanned USGS Quad Image (MrSID format) - Digital version of all the USGS Topographic maps for Massachusetts on one CD. Includes: ▪ One seamless statewide image, 2-meter pixel resolution, in MrSID format. ▪ .SDW header file for georeferencing in GIS software ▪ Complete metadata (documentation)	**$50.00**

Custom Data Products

Custom data orders cost **$50.00 per CD**. Each CD holds a maximum of 650 megabytes of data and may include any of the following:

Vector Data

- **ARC/INFO Export Files** for a user-specifed region of the state (i.e. a town, watershed, etc.)
- **ESRI Shapeiles** for a user-specifed region of the state (i.e. a town, watershed, etc.)

Orders of this type may include all Available Layers, or just certain themes. User must specify an area of interest when ordering.

Image Data

When ordering a custom CD of images, you may choose any of these listed here. On the orderform simply list the resolution and type and provide an area of interest (i.e. "1- and 2-meter black & white Tiffs for the Town of Braintree")**.**

1:5,000 Black & White Orthophotos

- 1-meter (TIFF and MrSID formats, individual images)
- 1-meter (MrSID format - large regional mosaics; see tiling scheme at back of catalog)
- 2-meter (TIFF only)
- 5-meter (TIFF only)
- half-meter (MrSID and BIL formats)

Coastal Color Orthophotos

- 1-meter (TIFF and MrSID formats)
- 2-meter (TIFF only)

To help figure the total cost of a custom order of images, use this table of individual ortho file size and CD capacity:

Image Type	Pixel Resolution	TIFF		MrSID	
		File Size	Qty./CD	File Size	Qty./CD
1:5000 Black & White	1/2 meter *	64 MB	10	5 MB	130
	1 meter	16 MB	40	800 kb	750
	2 meter	4 MB	162	n/a	-
	5 meter	640 kb	1015	n/a	-
Coastal Color	1 meter	48 MB	13	2.5 MB	260
	2 meter	12 MB	54	n/a	-

* - Half-meter orthos are available in BIL, not TIFF format. BIL images may be used in ArcInfo and ArcView as well as other software. MassGIS will convert the BILs to TIFFs for an additional charge of $25 per order.

A Note about DXF Data

Users often request data from MassGIS as DXF files for use in AutoCAD software. Though MassGIS does not produce or maintain data in DXF format, users may convert our data to DXF via one of the following methods:

- Load any data into the free "DXFAuthor" utility, a stand-alone piece of software for Windows 95/98/NT 4.0. A series of Wizards will lead you through the conversion process. Please see the Web page http://www.state.ma.us/mgis/ dxf.htm for details and to download.
- Load any of our data in Arc coverage format into ARC/INFO and use the ARCDXF command

How to Order Data

- **Data Purchase** - Available to all users from either the public or private sector by submitting the MassGIS OrderForm:
  - Use the Online Order Form at http://www.state.ma.us/mgis/order.htm, or
  - Print a copy of the Order Form for Digital Data at the end of this section

Fax it to **(617) 626-1249**, or mail to: **EOEA - MassGIS**
Attn: Data Request
251 Causeway St., Suite 900
Boston, MA 02114

Note: This is a new address and fax for MassGIS (as of Nov. 2000)

If an order is placed online or by fax, or if a mail request does not include payment, an invoice for total fees will be included with your order. Payment is to be made via check or money order made out to the *Executive Office of Environmental Affairs*. We do not accept cash or credit cards.

Order Form for Maps

to be provided by the Massachusetts Executive Office of Environmental Affairs

Please use this order form to request one printed map to be generated using MassGIS data. The MassGIS *Datalayer Descriptions and Guide to User Services* describes the available map themes and datalayers in detail; to receive a copy please check this box: ☐

Step 1: Provide the following Client Information:

Organization			Date
Contact Name			Check or P.O. #
Address			Telephone
Town	State	Zip Code	FAX
E-Mail Address			

Step 2. Choose a Map Theme:

$25.00 each ($5.00 for additional copy of same map):

___ Land Use
___ Open Space
___ Title 5
___ Wetlands Habitat
___ Surficial Geology
___ DEP MCP (21E) NRS (Site or Large Format Map)
___ Water Supply Protection
___ Water Supply Protection/Land Use
___ Solid Waste Assessment
___ Solid Waste Facilities/Selected Natural Resources
___ Priority Resources
___ Open Space/Water Resources
___ Community Water Supply
___ Outstanding Resource Waters

$20.00 each copy:

___ DEP Eelgrass Resources (32"x 38" page size)
___ Wetlands atop 2-meter Orthophoto (1:10,000)
___ Shoreline Change

$15.00 each copy:

___ DEP Eelgrass Resources (24"x 26" page size)
___ Wetlands atop 1-meter Orthophoto (1:5,000)

Step 3. Choose one of the following two formats:

____ **Large Format Map** (any theme listed above)
Map size and scale will vary depending on the area portrayed. Maximum size is 46" x 33". Maps of USGS quadrangles are printed at 1:25,000 scale.

List town, quad, or region name/number, or Shoreline Change ID:

_____ **Site Map** (21E Theme only)
Map will be 8½" x 11" in size and printed at 1:15,000 scale. Radii of 500 feet and ½ mile around the specified coordinates will be shown.

Coordinates (UTM or LL [deg, min, sec]) - **REQUIRED**
N
E/W
Site Name and address - OPTIONAL

Basic fee (see costs listed above in Step 2):	
Additional copies of the same map _____	
TOTAL - Please attach a check or money order or a purchase order for this amount:	

Please print this form and return with a purchase order, check or money order payable to the Executive Office of Environmental Affairs. Mail to EOEA-MassGIS, Attn: Map Order, 251 Causeway Street, Suite 900, Boston, MA 02114 or Fax to (617) 626-1249. Phone (617) 626-1237 / -1057

Also order online: http://www.state.ma.us/mgis/order.htm

Order Form for Digital Data

to be provided by the Massachusetts Executive Office of Environmental Affairs

Please use this order form to request one printed map to be generated using MassGIS data. The MassGIS *Datalayer Descriptions and Guide to User Services* describes the available map themes and datalayers in detail; to receive a copy please check this box: ☐

Step 1: Provide the following Client Information:

Organization			Date
Contact Name			Check or P.O. #
Address			Telephone
Town	State	Zip Code	FAX
E-Mail Address			

Step 2. Specify which Data Products you wish to receive:

MassGIS Data Viewer:

___ Regional CD. Specify Area (town, watershed, etc): _____ $50.00

(If Viewer requires multiple CDs, a charge of $50 will be added for each additional CD)

___ Statewide Data (4-CD set) $100.00

Vector Data:

___ Statewide Data - ESRI Shapefile format (Does not include PT Elevation Data) $100.00

___ Statewide Data - ARC/INFO Export File format (Does not include PT Elevation Data) $100.00

Point Elevation Data: ___ ESRI Shapefiles (2 CDs); ___ ARC/INFO Export Files (3 CDs) $75.00

Image Data:

Digital Orthophotos:

___ Individual 1-meter 1:5,000 Black & White (MrSID Format) - 3 CDs, 1600 individual images $100.00

___ 1-meter 1:5,000 Black & White Mosaics (MrSID Format) - 10 CDs, 10 individual images $200.00

___ Individual half-meter 1:5,000 Black & White (MrSID Format) - 10 CDs, 1600 individual images $200.00

___ 1-meter 1:10,000 Color Coastal Mosaic (MrSID Format) - 1 seamless image $50.00

Scanned USGS Quads:

___ Scanned USGS quads - (Tiff format, by orthoquad) – 5 CDs, 1600 individual images $100.00

___ Scanned USGS quads - (MrSID format, by orthoquad) - 1 CD, 1600 individual images $50.00

___ Scanned USGS quads - (MrSID format) - 1 seamless image $50.00

Custom Order:

Provide area of interest (i.e. town, watershed, etc) and image format (Tiff or MrSID) and resolution $50.00 per CD

TOTAL

Redistribution Agreement

The Massachusetts Executive Office of Environmental Affairs distributes digital cartographic data under the terms and conditions as outlined in the Purchase Agreement for Digital Data Provided by the Massachusetts Executive Office of Environmental Affairs. I/we acknowledge that submission of this order binds us to the terms and conditions of the agreement concerning use and distribution of this data that we have read and understand.

Authorized Signature _____ **Date** _____

Please print this form and return with a purchase order, check or money order payable to the Executive Office of Environmental Affairs. Mail to EOEA-MassGIS, Attn: Data Order, 251 Causeway Street, Suite 900, Boston, MA 02114 or Fax to (617) 626-1249. Phone (617) 626-1237 / -1057

Note MassGIS' new address and phone and fax numbers (as of Nov. 2000)

Also order online: http://www.state.ma.us/mgis/order.htm

MassGIS DATA DISTRIBUTION POLICY

Introduction

MassGIS is no longer using a "memorandum of understanding" (MOU) for data distribution; we have been advised that, legally, the existing MOUs are not appropriate.

MassGIS data are free to anyone who downloads them from the MassGIS web site. Maps created through our web site (via the Online Mapping section) will also be free. The only other maps we provide are the standard "Themes" (see page 7). If you cannot download data from our web site, you may request that a copy be sent to you. You may or may not be charged a reproduction fee (as provided for under Massachusetts public records laws - see the MassGIS purchase agreement for digital data in the next section; also see the Custodian of Public Records Web site at http://www.state.ma.us/sec/pre/preidx.htm), depending on what you are requesting and what kind of requestor you are. The categories of requestor are:

- Massachusetts Public Agencies, including public schools (no fees)
- Private Individuals, Private Companies, Non-Profit Organizations, and Non-Massachusetts Public Agencies (pay reproduction fees)
- Data Cooperator (no fees)
- Data/Map Grantee (no fees)

Details on each category are listed below.

Map Categories

"Maps" on this page refers to Large-format maps. All parties must pay for DEP MCP 21e Site Maps.

There are two maps for which there is always a reproduction fee:

1. Department of Environmental Protection (DEP) wetlands maps on orthophoto base (each copy $20 or $15, depending on paper size)
2. The Department of Fisheries, Wildlife, and Environmental Law Enforcement's (DFWLE) Natural Heritage and Endangered Species Program wetland habitat maps (first copy $25, subsequent copies $5).

These two maps are made by MassGIS for their respective agencies, which have established a policy of charging a fee to all map recipients.

3. Custom maps

We are not obligated by public records laws to create maps for which there is not already a software program that creates them. If we agree to create a custom map, the fee is the cost of the time (based on hourly rates for salary and overhead) for the staff person assigned to the task. This includes time needed for defining the map's scope (its geographic extent, scale, content, and purpose), time for producing any map drafts, and time for producing the final version of the map. Typically, a custom map requires one or two days of work, and does not involve creating map features not already in our database. Thus custom map costs will likely be between 150 and 300 dollars, or more. We typically do not accept requests for custom maps.

Data Distribution Requestor Categories

Massachusetts Public Agencies: No Fee for standard maps or data

You are a member of this category if you are:

- a state, regional, local government (town/city),
- or public educational institution. Public educational institutions include public elementary, middle, and high schools and the public colleges and universities (see Appendix A at the end of this section).

Data requests from state, regional, or local government agencies must be made by an employee. Individuals requesting data will become the point-of-contact for their department within their parent organization (e.g. town

department, agency bureau, etc.), and future requests may be referred to that individual. Requests from people at educational institutions must be made by a faculty or staff member, and there can only be one data recipient per department. Requests in this category are subject to the following limits:

- No more than 5 standard maps may be requested annually
- The data requested will fit on no more than 3 CDs
- A specific data layer may be requested once annually and if it has not changed since the last request, it will not be supplied again.

Citizens groups involved in public agency initiatives (e.g. watershed groups) cannot request data directly without paying the copying fees. An employee of the Massachusetts public agency involved may request the data directly and pass data on to the citizens group

Private Individuals, Non-Profit Organizations, Private Companies & Non-Massachusetts Public Agencies: Fee charged for maps and data

You are a member of this category if you are:

- a private company (consultant, engineering firm, etc.),
- a federal government or out-of state public agency,
- or a non-profit organization.

Private companies under contract to public agencies will be charged a fee. Public agencies may request the data directly for no fee and then pass it on to their contractors. Federal government agencies may become data grantees and non-profit organizations may become data cooperators or data grantees as described below.

Data Cooperator: No fee for data and up to 10 maps annually

Non-profit organizations may be eligible to become data cooperators and receive data with no fee. A data cooperator relationship is established by providing MassGIS with updates to an existing MassGIS data layer OR by providing metadata (in database or ASCII text format) for data sets developed by the non-profit organization. If a data cooperator is providing updates or additions to a data layer maintained by MassGIS, first contact MassGIS. Any updates/additions must be consistent with standards (accuracy, attribute naming and coding, etc.) established for the data layer by MassGIS. Metadata MUST comply with either the metadata standard established by the Federal Geographic Data Committee OR (for those familiar with it or with a preference for it) with the MassGIS metadata standard. Database file templates (dBase format) for MassGIS metadata are available on the MassGIS web site. Information about the FGDC metadata standard and tools for creating FGDC compliant metadata may be found on the MassGIS web site (on the Metadata Resources page – http://www.state.ma.us/mgis/munimeta.htm).

Once MassGIS has notified the organization in writing that it has been granted data cooperator status, the organization may request data on CD-ROM as a data cooperator. This request may occur no more than annually unless there is a project-specific need or there has been a substantial change to a data layer. Image files (e.g., orthophotos, USGS quadrangles) for a given area will not be provided more than once unless new imagery has been created. MassGIS may also request copies of any data sets developed by the data cooperator.

Data/Map Grantee: No fee for standard maps or data

There are two types of organizations in this category: (1) those working on projects involving the Executive Office of Environmental Affairs (EOEA) or any of its departments, and (2) those with no such project relationship.

1) Organizations working with EOEA or its one of its departments may be granted data or maps for a specific project (such as a buildout, an open space plan or community preservation plan) through a prior arrangement made with an EOEA employee. When requesting data through this category, the EOEA project and the contact's name, title, and phone number MUST be identified. Prior to requesting the data, the EOEA contact person should notify the MassGIS data orders staff via email (onlinemaps@MassMail.state.ma.us; put "fee status confirmation" in the e-mail subject if it does not automatically appear) stating who the request will come from and for what project.

2) MassGIS will also consider data or map-grant requests from organizations having no relationship to EOEA or its departments and meeting at least three of the following criteria:

- They cannot download data from MassGIS' web site (lack of or inadequate internet access)
- The organization is requesting data for an area that is less than 10 towns or that is a single watershed

- Their staff capable of using GIS software does not exceed two
- The organization's budget is less than $250,000
- Number of maps requested is no more than 5 and the data requested includes no more than 3 CDs requiring custom preparation.

If an organization wishes to be considered for a data or map grant, someone from that organization must submit the request in writing or via e-mail. The request must include the organization's name, the name and contact information for the person making the request, and what they are requesting. The request must identify which of the above criteria the requesting organization meets. Written requests should be mailed to:

MassGIS
251 Causeway Street, Suite 900
Boston, MA 02114
ATTN: Data Grant Requests

E-mail requests should be sent to onlinemaps@MassMail.state.ma.us; put "Data Grant Request" in the e-mail subject header if it does not automatically appear.

APPENDIX A - Massachusetts Public Universities and Colleges

University of Massachusetts Campuses

- Amherst
- Boston
- Dartmouth
- Lowell
- Medical Center

Massachusetts State Colleges

- Bridgewater State College
- Fitchburg State College
- Framingham State College
- Massachusetts College of Art
- Massachusetts College of Liberal Arts
- Massachusetts Maritime Academy
- Salem State College
- Westfield State College
- Worcester State College

Massachusetts Community Colleges

- Berkshire Community College
- Bristol Community College
- Bunker Hill Community College
- Cape Cod Community College
- Greenfield Community College
- Holyoke Community College
- Massachusetts Bay Community College
- Massasoit Community College
- Middlesex Community College
- Mount Wachusett Community College
- North Shore Community College
- Northern Essex Community College
- Quinsigamond Community College
- Roxbury Community College
- Springfield Technical Community College

PURCHASE AGREEMENT FOR DIGITAL DATA PROVIDED BY THE MASSACHUSETTS EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS

This Agreement outlines the recommended terms for purchase of digital data and/or digital data products provided by the ***Massachusetts Executive Office of Environmental Affairs*** (herein EOEA), located at 251 Causeway Street, Suite 900, Boston, MA 02114.

AUTHORITY

The legal authority for EOEA to recover and retain fees for the distribution of data under the terms of this Purchase Agreement is ***G.L.M. Chapter 240, Section 2C, line 2001-1001 of the Acts of 1989*** wherein EOEA is authorized to render "data processing services to state agencies, authorities and units of government within the Commonwealth" and to distribute "digital cartographic and other data". The fee schedule for the distribution of digital data and digital data products is established in ***Chapter 653, section 138, of the 'Budget Control and Reform Act of 1989'.***

JUSTIFICATION AND PURPOSE

EOEA administers, supervises and/or funds a variety of regulatory and management programs that are important to the environmental resources of the Commonwealth. EOEA and its agencies manage the Environmental Affairs Data Center, the MassGIS and several other environmental information system units which support their information management needs. It is the policy of EOEA to provide to its agencies, and other agencies, authorities and units of government and the private sector within the Commonwealth access to data and data processing services which will enhance the quality of environmental regulatory, management and resource decisions. It is the expressed intent of the General Court that EOEA should recover some of the costs associated with the provision of data and data processing services.

USE OF DATA PROVIDED BY EOEA

Data purchased from EOEA are part of the public record and subject to all the provisions of the Public Records Law. However, data provided by EOEA are intended for the use of the receiving agency, organization or individual. Re-distribution of the data by receiving agency without notification to EOEA is discouraged. EOEA suggests that recieving agencies, when possible, refer other parties interested in obtaining EOEA data directly to MassGIS. This recommendation is made in an effort to maintain data currency and ensure that data are correctly documented for the eventual user.

All maps or other documents produced using data or data products supplied through this agreement should contain a data source credit, prominently displayed, such as "source data supplied by the Massachusetts Executive Office of Environmental Affairs, MassGIS."

EOEA suggests that the purchasing agency, organization or individual employ using the data, attach or release a statement which includes the following.

"These digital data represent the efforts of the Massachusetts Executive Office of Environmental Affairs and its agencies to compile or record information from the cited source materials. EOEA maintains an ongoing program to record and correct errors in these data that are brought to its attention. EOEA makes no claims as to the absolute validity or reliability of these data or their fitness for any particular use. EOEA maintains records regarding all methods used to collect and process these digital data and will disclose this information upon request."

MassGIS Data Viewer

Introduction

The MassGIS Data Viewer is distributed on CD and contains MassGIS data for a specific area in Massachusetts (or for the entire state), and some tools with which to view the data. The Geographic Information System (GIS) data on the CD is a subset of the ESRI ARC/INFO format vector data which MassGIS maintains as Librarian Coverages. The CD(s) may also contain a subset of the image data (i.e orthophotographs and/or scanned USGS Topographic Quadrangle maps) that MassGIS maintains.

The MassGIS Data Viewer is a customized ArcView project (ArcView is an ESRI product). It consists primarily of a few key enhancements to native ArcView. The MassGIS Data Viewer was created specifically to be distributed and work with MassGIS data. However, it also was designed to be generic enough to work with any other spatial data supported by ArcView. The CD contains Data Viewer versions for users that have the ArcView software, as well as a "Runtime" version of the Data Viewer for does not require ArcView. See below for details on the "Runtime" Viewer.

What the MassGIS Data Viewer Contains

MassGIS Data Viewers are available for a particular region (one town, a few towns, a watershed, etc.) or for the entire state. All Viewer CDs contain the customized ArcView projects explained above.

Custom Regional Viewers include:

- all point, polygon and vector data that overlap the requested region in ARC/INFO Librarian format (except the Natural Heritage and Endangered Species Program data, which are available for download at the MassGIS web site),
- Scanned USGS Topographic Quadrangle Maps,
- Black & White or Color digital orthophotos in MrSID format, (space permitting).

Statewide Viewers include only vector data and are available as a 5-CD set. Images are available separately as sets. See the page on Data and Map Ordering Services for pricing and ordering information.

Enhancements in the Viewer vs. "Regular" ArcView

Some of the enhancements in the MassGIS Data Viewer include:

- A set of menu choices that group the MassGIS datalayers into useful categories. It is easy to find the data you wish to view - the user does not have to know how the data is tiled or where it is stored.
- A set of menu choices for zoom extents so that it is easy to move around the state
- The ability to zoom to a Latitude/Longitude or UTM point
- Default legends and symbolization for datalayers
- The ability to save and name extents so that you can return to them quickly without rezooming
- Built-in documentation on each MassGIS datalayer
- In the full version of the Data Viewer for ArcView, simplified address-matching or geocoding

The Data Viewer does not disable any regular ArcView functions. Some documentation is included for those users who wish to further customize the project and add their own scripts, and more information is available upon request.

PC Specifications for Running the Data Viewer

The Data Viewer requirements are the same as those for ArcView. A minimum of 32MB of RAM is required, but 64 or more is preferred. The more memory the computer has the faster all processing will be. If the Data Viewer comes on one CD the GIS data can be left in the CDROM drive since access to CDROM drives is fast. The GIS data may be copied to the hard drive if desired. When a set of data spans more than one CD, all the data on the CDs

should be copied to the hard drive so that the Data Viewer has access to all datalayers at all times. The full version of the Data Viewer - the ArcView project file and associated tables -use about 5 MB of hard drive space. The "Runtime" version of the Data Viewer program, which must be installed on the hard drive if you do not have a full version of ArcView, uses about 40 MB of hard drive space. The full version of the Data Viewer will run with ArcView on Windows 95/98/NT, or UNIX. It is assumed that it will run with Windows 2000. The runtime Data Viewer requires Windows 95/98/NT or Windows 2000.

"Runtime" Data Viewer

The Runtime Data Viewer is a stand-alone piece of software: a "light," or scaled-down version of ArcView GIS 3.1.1 that offers much of the map-making functionality of the full software package. Included with all versions of the MassGIS Data Viewer CD products, the Runtime Data Viewer lets you display all the MassGIS data, change their symbolization, add symbols and text to the map, create a map layout with map elements such as a scale bar, north arrow, legend and title, and print your layout. The Runtime Data Viewer also gives you the ability to save any finished map layout as a bitmap image, Windows Metafile, or Postscript file, which then may be brought into a variety of other software. The Runtime Data Viewer will not save a project, edit tables, or create shapefiles, so it may not be comprehensive enough for everyone. However, it can be a way to get started with GIS and the datalayers MassGIS offers.

Watershed Analyst

The MassGIS Watershed Analyst is a set of menu choices and tools included in all full versions of the MassGIS Data Viewer. The menu choices and tools can be displayed or hidden, depending on whether you need them. The menu choices and tools deal with various aspects of watershed analysis. The user can trace upstream in the watershed network, place points or lines on the river network, or delineate a watershed from any chosen point, line or polygon. A "raindrop" tool is also available, allowing the user to follow the path of a drop of rain over land. The raindrop tool and tools for watershed delineation require ArcView's Spatial Analyst Extension software version 1.1 or higher and also a MassGIS extension called the MassGIS Watershed Delineator (watdelin.avx). The Watershed Analyst tools may be used in ArcView GIS 3.0a/b, ArcView GIS 3.1, and ArcView GIS 3.2 or 3.2a (UNIX or PC). Visit http://www.state.ma.us/mgis/vwr_wa1.htm for complete documentation on the Watershed Analyst.

Support

Documentation and other Viewer information may be found on the MassGIS Web site. For complete details visit http://www.state.ma.us/mgis/viewer.htm. For more information contact Aleda Freeman at (617) 626-1193 or by e-mail at Aleda.Freeman@state.ma.us. Viewer technical support questions also may be submitted through our Online Technical Support system at http://www.state.ma.us/mgis/vwr_help.htm.

Other Services Offered by MassGIS

Scanning

MassGIS maintains a Tangent CCS 500 50 FT E-size color drum scanner. Scanning services are available on a limited basis for small data conversion projects.

GPS

MassGIS has a number of Global Positioning System (GPS) units available for project use. MassGIS has purchased Trimble GeoExplorer units with a corrected accuracy of 3-5 meters. Training materials and limited technical assistance are provided by MassGIS.

Coordination and Assistance

MassGIS will provide guidance to cities, towns and others interested in learning more about or acquiring GIS technology. MassGIS tracks GIS activities, maintains a library of reference materials on GIS topics, facilitates data development through data exchange agreements, and is available to meet with groups interested in GIS.

DATALAYER DESCRIPTIONS

Overview

MassGIS data can be divided into two broad categories: **base map** data and **environmental** data. As described below, these data have been developed at a variety of scales (see the section Understanding Scale below for a brief description on map scale). The data may also be categorized further, based on types of geographic features, such as infrastructure, physical resources, and political boundaries. This page describes the two broad categories. For descriptions on individual layers see the Available Datalayers page, on which the data are organized within the more-detailed categories. Note that the date below each datalayer description title represents the month and year of that layer's most recent update.

The datum for the MassGIS database is North American Datum 1983 (NAD83). The data are registered to the Massachusetts State Plane Coordinate System, Mainland Zone (Fipszone 2001). Units are meters. (Some imagery for Martha's Vineyard and Nantucket are also available in the Mass. Stateplane Island Zone). The Massachusetts State Plane Coordinate System, Mainland Zone is defined as follows:

```
Projection:             Lambert Conformal Conic
Spheroid:               GRS 80
Central Meridian:       -71.5
Reference Latitude:     41
Standard Parallel 1:    41.71666666667
Standard Parallel 2:    42.68333333333
False Easting:          200000
False Northing:         750000
```

Base Map Data

In its role as a repository for GIS data, MassGIS is responsible for maintaining the "base map" datalayers that commonly appear on many kinds of maps. These datalayers include features such as roads, streams, and political boundaries--relatively permanent, widely used features. Many of the base map datalayers maintained by MassGIS have been derived from U.S. Geological Survey data and represent many of the feature types found on USGS topographic maps. More recently developed data were derived from the digital orthophotos providing improved basemap accuracy.

Several of the MassGIS base map features are available in two scales. So-called "**Quad" scale** datalayers were typically compiled from 1:25,000 scale maps (the scale used on the popular USGS 7.5 minute topographic map quadrangles) and are suitable for spatial analysis of larger areas such as counties or of entire towns. MassGIS is making increasing amounts of **large-scale** data available that is suitable for spatial analysis within towns or of individual parcels of land. Large-scale data have been developed from the EOEA digital orthophotos. This 1:5,000 scale base map is now considered the new state basemap for data. Other datasets have been developed at smaller scales (1:100,000 or 1:250,000). The individual description pages state the layer's scale.

In addition to vector (point/line/area) data, MassGIS also distributes image data, including Black & White Digital Orthophotos, Scanned USGS Quads, and Coastal Color Orthophotos. The imagery is available in Tiff and MrSID formats.

Environmental Data

In addition to base map data, MassGIS distributes datalayers developed by EOEA and its agencies. These datalayers include those developed by the agencies for the purpose of enforcing environmental regulations or in support of various types of environmental analysis. Responsibility for maintaining and updating these datalayers remains with the agencies that produced them, as indicated in the individual descriptions. Many of these datalayers were compiled at "Quad" scale and are suitable for spatial analysis using the MassGIS base map data.

Understanding Scale

Scale is defined as the ratio of the distance measured on a map to that measured on the ground between the same two points, in the same units). Scale is represented on this web site as a ratio, such as 1:25,000 (read "one-to-25,000") which means one inch measured on the map equals 25,000 inches in the real world). Scales are relative: the term "**large scale**" describes data with more detail than "**small scale**" data. For example, data at 1:25,000 is at a smaller scale than data at 1:5,000, but at a larger scale than data at 1:100,000. In other words, the larger the ratio, the smaller the map scale. Therefore, a map of the world would have a very small scale, whereas a map of a town center will have a large scale.

GIS data can be displayed at any scale, but disregarding the scale of the source material can create problems. For example, if contour lines compiled at the very small scale of 1:250,000 are displayed at 1:25,000 with water resource features developed at much larger scale of 1:25,000, contour lines will appear to cross lakes and ponds --an obvious error. GIS data should not be displayed beyond the accuracy at which the data was developed.

Current Data Initiatives

One of the most important functions of the MassGIS staff is to maintain and expand the digital database. Spatial data are constantly changing and new data sources become available. The following section describes active data development projects. For the most current status on these and other projects, please refer to the status maps on the MassGIS Web site at http://www.state.ma.us/mgis/maps.htm.

- **Soils:** A soils datalayer has been automated from the USDA Natural Resources Conservation Service (NRCS) 1:25,000 published soil surveys. All soils data released by MassGIS have been "SSURGO-certified," which means they have been reviewed and approved by the NRCS and meet all standards and requirements for inclusion in the national release of county-level digital soils data. Soils data are currently avaialable for Norfolk and Suffolk counties, Hampden/Hampshire East, Hampden/Hampshire West, and Berkshire County. This datalayer will be under development until complete coverage exists across the state. Work is now underway in parts of Worcester, Bristol, Middlesex, Plymouth, and Franklin Counties, using soils surveys updated and/or recompiled onto 12:000 USGS orthophotography. See http://www.state.ma.us/mgis/st_soi.htm.

- **1:5,000 Orthophoto Wetlands:** Complete coverage is now available for Cape Cod, metropolitan Boston and the North Shore, parts of the South Shore and Buzzards Bay Watershed, along with parts of the Quabbin-Ware-Wachuset Waterhsed district. Development by the DEP GIS Group is continuing, with southeastern Massachusetts the current priority region. See http://www.state.ma.us/mgis/st_wet.htm.

- **1:5,000 Statewide Digital Orthophotography:** As of March 2000, MassGIS has full statewide coverage for the 1:5,000 black and white Digital Orthophotography datalayer. With some of the original photography captured more than eight years ago, the next phase in this project will be to update areas covered by these

older photos. A timeframe for beginning this phase is yet to be determined. See http://www.state.ma.us/mgis/st_oq.htm.

- **1:5,000 3-Meter Contours:** With the statewide orthophotography program complete, the related elevation data are in the final phases of processing and quality control. Currently the western and south-central regions need to be completed for the Contours, Breaklines, and Elevation Points layers. Estimated date of completion is March 2001. See http://www.state.ma.us/mgis/st_hp.htm.

- **Stream Network Centerlines:** Work is underway to complete a single-line centerline network on the 1:25,000 hydrography. True single-line features (such as streams or canals) are supplemented by GRID-derived centerlines which flow through polygon features (ponds, wetlands, doublewide streams, etc). This network representation of basins allows for analysis and querying to answer upstream/downstream and other hydrologic or basin-oriented questions. A route-system will be in place on the network with complete coding of the existing SARIS coding scheme. See http://www.state.ma.us/mgis/st_wa.htm.

- **Municipal Zoning:** MassGIS is collecting and compiling municipal zoning districts and bylaws. MassGIS has collected zoning coverages developed by the Executive Office of Transportation and Construction (EOTC), the Regional Planning Agencies, and the Essex County Registry of Deeds. Others were digitized at MassGIS using town zoning maps and, where available, the 1:5,000 digital orthophotos. Unique municipal zoning codes have been preserved and a regional zoning attribute scheme was developed to facilitate regional analysis. Data scale and accuracy are variable. Currently MassGIS is receiving data for many communities through EOEA's Buildout Analysis Program in conjunction with its Community Preservation Initiative.

- **Land Use:** The University of Massachusetts at Amherst, under contract by EOEA, is developing complete statewide Land Use using aerial color infrared photography flown in the summer of 1999. Following extensive quality control and review, MassGIS will make the data available on a town-by-town basis as they are completed, beginning in late 2000. Project completion is expected by December 2001.

- **Protected and Recreational Open Space:** Though the original data-development phase of this project is complete, MassGIS continues to receive updates of Open Space data from regional planning agencies and municipalities, as well as by way of EOEA's Buildout Analysis/Community Preservation Initiative.

- **1:5,000 Roads:** During the development of the 1:5,000 Orthophotography program, road centerlines were captured statewide from the original half-meter 3D stereo models. MassGIS is currently in the initial stages of a "conflation" process – attaching the attributes from the Massachusetts Highway Department Roads Inventory File to the new unattributed ortho-scale linework. Upon completion, MHD will use the "conflated" linework for all its future data updates and the "5k Roads" layer will be the default release of street data by MassGIS.

- **Municipal Boundaries:** Based on survey-control monument data recorded in historical atlases located at the Massachusetts Highway Department, this new datalayer will replace the current "TOWNS" and "BOUNDARIES" layers. Town corners were recorded, in most cases, in Latitude-Longitude coordinates precise to 1/1000 of a second.

MassGIS is continually working on its database, adding new datalayers and updating exiting ones. Some layers, like the DEP Zone IIs, IWPAs and Public Water Supplies are updated on a fairly regular schedule, approximately every three or four months. Others, like Areas of Critical Environmental Concern, are updated as new features are added. New datalayers also are brought online on an irregular basis. For the most up-to-date information on new layers and other data changes, please see http://www.state.ma.us/mgis/whatsnew.htm.

Basic Librarian Concepts

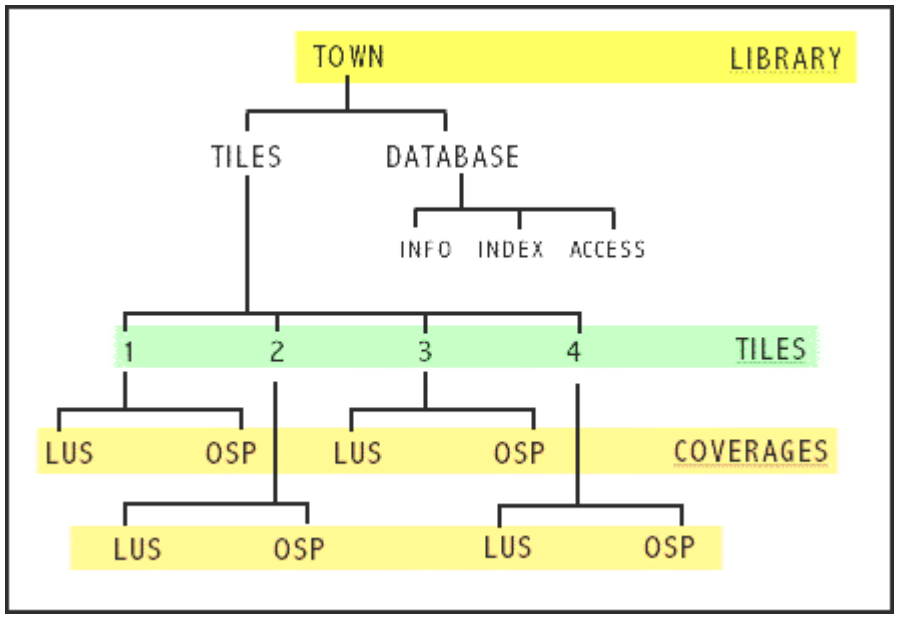
Storing Data in Librarian

For those users of MassGIS data who have elected to obtain the MassGIS Data Viewer, the accompanying data are distributed as ARC/INFO coverages, stored in ARC/INFO's Librarian format. Data libraries (sometimes called map libraries) are much like a traditional library in the sense that they both serve to store information in manageable pieces in an organized way. In a library of books, the books may be organized by topic (i.e. history, biography), divided into volumes and arranged on shelves for easy and rapid retrieval of information. The geographic data in MassGIS' libraries are organized by the way the layers are broken up into manageable pieces, called tiles. GIS data can often be large, and it is easier to work with smaller tiles rather than one statewide layer. Each library has a name, based on its tiling scheme. MassGIS tiles its data in the following ways:

- by quad (each USGS Quad represents a tile) - the "QUAD" and "QUAD2" libraries
- by town (each municipality represents a tile) - the "TOWN" library
- by basin (each basin represents a tile) - the "BASIN" library
- by watershed (each watershed represents a tile) - the "WATRSHED" and "WATRSHD2" libraries
- by Orthophoto Quad (each orthophoto quad represents a tile) - the "OQ" library

Some layers are small enough to use as one single statewide coverage. These layers are considered to be "tiled by the state" and are thus found in the "STATE" library. In addition, MassGIS maintains data that extend beyond the state boundary, such as the towns of the adjacent New England states; these layers are in a library known as "NE" - short for Northeast.

Unlike a book library, however, in which you access information one volume at a time, a digital map library allows you to access all the data in it as a whole, all at once, when using ARC/INFO or ArcView. Such a scheme simplifies data storage and data access by eliminating the need to know where data are stored in order to use them. In addition, data in Librarian format ensures attribute consistency across a datalayer. Librarian also allows the user to easily extract coverages from a library (i.e. "clipping out a chunk of data") by user-defined boundaries. For example, Landuse is tiled by town, but Librarian allows the user to extract a single coverage of landuse comprising several tiles by the user-supplied boundary of a river basin.



As illustrated in the graphic above, the libraries and tiling schemes correspond to the way the data files are physically stored in a computer or on media (such as a CD or tape). Each tile is a subdirectory within the appropriate library directory. The data, or coverages, are found under each tile. For example, in the Town library, the Landuse, Open Space, and TIGER Roads layers (coverages named LUS, OS, and TIG, respectively) are tiled by the town unit and stored under each town's tile directory. In the example above, the tile numbers represent unique town IDs. This reinforces the principle that data in a library are paneled **not** by datalayer, but by tile. Within a library, the coverages of a particular datalayer all have the same name in each tile directory. Hence, a layer has only one coverage name. Each library has a set of datalayers and corresponding coverage names.

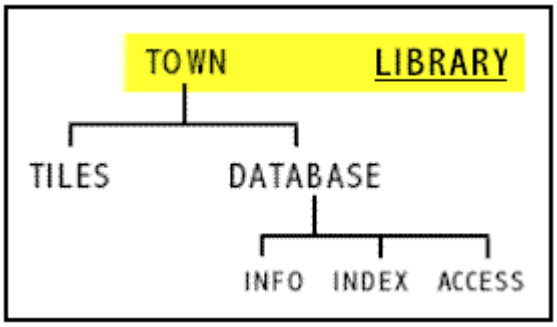
For the Town library, for example:

Layer Name	Coverage
LANDUSE	lus
OPENSPACE	osp
TIGER	tig

Please see the **MassGIS Library Scheme** on the following page for a complete listing of all the MassGIS libraries and the layers and coverages each contains.

The "Database" Directory

Parallel to the tile directory structure is the DATABASE directory for each library. Information about the library and its layers is found here.



The index polygon coverage (always called Index), upon which the library tiling scheme is based, is kept in DATABASE. User access to the library and layers of the library are controlled here in the Access subdirectory. Though not illustrated in the diagram, template coverages are also stored in this directory. Template coverages are empty coverages for each layer which Librarian uses to store layer parameters (attribute items, item definitions, etc.). As part of these empty template coverages, the user will find all metadata files for the associated layers. The metadata explains all coding schemes, identifies data sources and provides all necessary information about the data. A full explanation of the naming conventions and related information about metadata may be found in the page titled "Standards for Documentation of GIS Coverages, Tables, Datalayers."

Below is one record of the INDEX.pat. The status of each layer and the location of each layer's tiles are attributes of the index coverage. The item LOCATION provides the path to the tile of a layer while TILE-NAME stores the name of the tile. The status of each layer is also stored in the Index. In the example below, TIGER, LANDUSE and OPENSPACE are attributes to the Index coverage representing each layer. For every tile where data are available, the layer status is coded P (present). If no data are available for the tile, the item is coded N (not present). Coding for status allows quick queries of data availability for a layer.

Sample Record of INDEX.pat:

```
AREA           = ************
PERIMETER      = 46813.086
INDEX#         = 12
INDEX-ID       = 21
TILE-NAME      = 341
LOCATION       = $TOWN/tiles/341
TOWN-ID        = 341
TOWN           = WILLIAMSTOWN
TIGER          = P
LANDUSE        = P
OPENSPACE      = P
```

MassGIS Library Scheme

Library	Layer	Coverage	What is it?
TOWN	LANDUSE	LUS	Land Use – 1971/85/90/91/92/95/97/99
	OPENSPACE	OSP	Open Space
	TIGER	TIG	Census Tiger Lines (Roads)
QUAD	COAST	CS	1:25,000 Coastline
	GEONAMES	GNM	Geographic Place Names
	HYDRO	HD	1:25,000 USGS Hydrography
	MHDROADS	MRD	Mass. Highway Dept. Roads
	Q3FLOOD	Q3	FEMA Flood Data
	T5	T5	Title 5 Setback Areas
QUAD2	NWI	NWI	National Wetlands Inventory
	SOILS	SOI	Soil Types
	SOILSPOT	SPO	Soil Spot Features
	ZONING	ZN	Municipal Zoning Districts
	ZONINGOV	OV	Zoning Overlay Districts
BASIN	AQUIFERS	AQ	Aquifers
	CONTOURS250	HP250K	1:250,000 Topographic Contours
	HD100	HD100_	1:100,000 Hydrography
	SUB_BASINS	SUBBAS	Sub-basin Boundaries
WATRSHED	NETWRK	CL_	Networked Hydro Centerlines
WATRSHD2	NAT-COR	NATC	Natural Land Riparian Corridors
	NATLANDS	NATL	Contiguous Natural Lands
	RIP-COR	RIPC	Riparian Corridors
	SURF_GEOLOGY	SG	Surficial Geology
OQ	ANNO_OQ	AN	Orthophoto Annotation
	CONTOURS	HP	Orthophoto 3-meter Contours
	STREAMS	S	Orthophoto 1:5,000 Streams
	WETLANDS	W	Orthophoto 1:5,000 Wetlands
OQE	BREAKLINES	L	Orthophoto Breaklines
	ELEVATIONS	P	Ortho Point Elevations
EOEAONLY	CVP9901	CVP9901	NHESP Certified Vernal Pools
	PHAB9901	PHAB9901	NHESP Priority Sites – Rare Species Habitats
	WHAB9901	WHAB9901	NHESP Estimated Habitats of Rare Wildlife
NE	ANADFISH	ANADFISH	Anadromous Fish
	ATLNPROV	ATLNPROV	Atlantic Provinces
	BATHYMGM	BATHYMGM	Bathymetry for the Gulf of Maine
	BTHOS250	BTHOS250	Offshore Bathymetry (1:250,000)
	CTTOWNS	CTTOWNS	Connecticut Towns
	DSGA	DSGA	Designated Shellfish Growing Areas
	GEONAMES	GEONAMES	Geographic Annotation
	GRID10K	GRID10K	MA Stateplane Grid and Points
	LOB-HARV	LOB-HARV	Lobster Harvest Zones
	METOWNS	METOWNS	Maine Towns
	MINLL1	MINLL1	One-Minute Latitude/Longitude Grid
	MINLL10	MINLL10	Ten-Minute Latitude/Longitude Grid
	NAUTICAL	NAUTICAL	NOAA Chart Major Linework
	NEWENGLAND	NEWNGLND	NE States
	NE_MASK	NE_MASK	States Bordering Mass.
	NHTOWNS	NHTOWNS	New Hampshire Towns
	NOAAINDX	NOAAINDX	NOAA Nautical Chart Image Index
	NYTOWNS	NYTOWNS	New York Towns
	OCEANMSK	OCEANMSK	Ocean Mask around New England
	OFFSH80K	OFFSH80K	Offshore Town Boundaries
	RITOWNS	RITOWNS	Rhode Island Towns
	SANCTUARY	SANCT	Federal & State Marine Sanctuaries
	SEA_MASK	SEA_MASK	Ocean Off Mass. Coast
	SHLFSHST	SHLFSHST	Shellfish Sampling Stations
	VTTOWNS	VTTOWNS	Vermont Towns
STATE	AB_CRAN	AB_CRAN	Abandoned Cranberry Bogs
	ACECS	ACECS	Areas of Critical Environ. Concern
	AQUEDUCTS	AQUEDUCT	Aqueducts
	AQ_SOLE	AQ_SOLE	Sole Source Aquifers
	BARRIERB	BARRIERB	Barrier Beaches
	BOUNDARY	BOUNDARY	Municipal Boundaries (no coast)
	BWPMAJOR	BWP_MAJ	DEP BWP Major Facilities
	C21E	BWSC_DEP	DEP Tier Classified Chapter 21E Sites
	CANOEACCESS	RIVRECPT	Canoe Access Points
	CANOETRIPS	RIVTRIP	Canoe Trips
	CBRS	CBRS	Coastal Barrier Resource Units
	CIR93	CIR93	Color Infrared Flight Lines
	CONGRESS	CONGRESS	Congressional Districts
	COQMAIN	COQMAIN	Color Coastal Orthophoto Index

STATE (cont.)	COUNTIES	COUNTIES	Counties
	COUNTYNC	COUNTYNC	Counties (no coast)
	CSTZONE	CSTZONE	Mass. Coastal Zone
	CZMSHEET	CZMSHEET	CZM Sheet Index
	DCSITE98	DCSITE98	USGS Data Collection Stations
	DWM_STATIONS	DWM_STAT	DEP Water Monitoring Stations
	ECO_REGIONS	ECO-REG	US EPA Ecoregions
	EELGRASS	EELGRASS	DEP Eelgrass
	EGRASVPT	EGRASVPT	DEP Eelgrass Field Verified Points
	EXITS	EXITS	Highway Exit Locations
	FISH-TRP	FISH-TRP	Fish Trap (Weir) Locations
	FIRMAOV	FIRMAOV	FEMA FIRM Zones V and AO
	GAGES94	GAGES94	Stream-Gaging Stations
	GWP	GWP	Ground Water Discharge Points
	HOUSE93	HOUSE93	House Districts
	IWPA	IWPA	Interim Wellhead Protection Areas
	IWPACOM	IWPACOM	IWPA for Community Wells
	LANDMARK	LANDMARK	Landmarks
	LDTRAILS	LDTRAILS	Long Distance Trails
	LUSTAT	LUSTAT	Year of Land Use
	MAJ_BAS	MAJ_BAS	Major Basin Boundaries
	MAJ_POND	MAJ_POND	Major Ponds
	MAJ_RD_MHD	MAJRMHD	Major Roads (from Mass Hwy Dept)
	MAJ_STRM	MAJ_STRM	Major Streams
	MBTA	MBTA	MBTA Rapid Transit
	MHDRDPTS	MHDRDPTS	Points for plotting road shields
	NPDWSACC	NPDWSACC	Cape Non-Pot. Drinking Water Areas
	OQISLE	OQISLE	OQ Index - Islands
	OQMAIN	OQMAIN	OQ Index - Mainland
	ORW	ORW	Outstanding Resource Waters
	OUTLINE	OUTLINE	State Outline (100k coast)
	OUTLINE25	OUTLN25	State Outline (25k coast)
	PAB	PAB	Public Access Boards
	PVP	PVP	NHESP Potential Vernal Pools
	PWS_DEP	PWS_DEP	Public Water Supplies
	QUADS	QUADS	Quadrangle Sheets
	RAILTRAILS	RAILTR	Rail Trails
	REG_DEM	REG_DEM	DEM Regions
	REG_DEP	REG_DEP	DEP Regions
	RPAS	RPAS	Regional Planning Authorities
	SCEN-INV	SCEN-INV	Scenic Landscapes
	SENATE93	SENATE93	Senate Districts
	SMRESTOR	SMRESTOR	Salt Marsh Restoration Sites
	SOILINDEX	SOILINDX	Soil Survey Sheet Index
	SOILSTAT	SOILSTAT	Soil Status Index
	SRHP[1-4,PT]	SRHP[1-4,PT]	State Register of Historic Places
	STELLBNK	STELLBNK	Stellwagen Bank Sanctuary
	SW	SW	Solid Waste Facilities
	TIDALRST	TIDALRST	Tidal Restrictions
	TOWNS	TOWNS	Town Boundaries (with coast)
	TRAINS	TRAINS	Trains
	TRANSLINES	TRNSLNS	Transmission Lines
	USGSGRID	USGSGRID	Digital Quadrangle Sheets
	UST	UST	Underground Storage Tanks
	UTMGRID	UTMGRID	UTM Grid
	UTMPOINT	UTMPOINT	UTM Points
	WATRSHDS	WATRSHDS	Major Watersheds
	WQM_STAT	WQM_STAT	Water Quality Monitoring Stations
	ZONEA / B / C	ZONEA / B / C	Zone A, Zone B, Zone C Surface Water Areas (3 layers)
	ZONE_IIS	ZONE_IIS	DEP Approved Zone Iis

Standard for Documentation of GIS Coverages, Tables, Datalayers

Overview and Objectives

This section presents standards and guidelines for complete documentation of GIS data within the MassGIS library. It provides for documentation of GIS data at various levels - globally for entire thematic layers, by individual coverage or by individual feature where data layers are derived from heterogeneous source material, as are open space data. The standard provides a structure for traditional data dictionary elements - definitions of attribute table items, listings of codes used, and other information that will make it possible for any user to access and use unfamiliar data. It also provides for a consistent approach to symbolization and for the documentation of links to related data files, both for geographic and for tabular data. Finally, the standard addresses the need to record the coincidence of geographic features, e.g. where a boundary is coincident with a road or a land-use category is coincident with a natural feature such as a riverbank. In this way, dissimilar scales can be reconciled without recourse to the original material when better quality basemap information becomes available.

Key Concepts and Definitions

A comprehensive and sustainable approach to the documentation of GIS data requires using a relational database framework in which it is possible to join the feature attribute tables to various meta-data tables. The approach presented here is based on the relational database contained in the ARC/INFO product, which is INFO. It can be implemented in any database system. The following definitions may be helpful for those not familiar with ARC/INFO GIS terms:

feature — A feature is the basic unit of ARC/INFO data. Features include **geographic features,** the familiar geometric abstractions of point, line and polygon representing the positions and boundaries in the real world of such entities as wells, rivers or parcels. **Records** in an INFO database **table**, not linked to geographic features, can still be manipulated by the same software commands in ARC/INFO and are also referred to as features in this standard.

feature attribute table — A feature attribute table is a particular type of table in an INFO database, which stores descriptive information linked to geographic features by unique IDs. The one-to-one correspondence between features and records in the feature attribute table is a key element of the data model - the unique identifier in the feature attribute record is the link to any other data which may be in a one-to-many relationship with the feature.

INFO table — An INFO table is a set of records with specific units of information stored in discrete fields with pre-defined data-types and format, just as records are stored in any relational database.

coverage — A coverage is a collection of geographic features and associated attribute information, analogous to a table in a database; it consists of a set of files describing topological and coordinate information for geographic features which are stored in a single coverage sub-directory and additional attribute files in INFO sub-directory. Attribute information may also be stored in other databases such as Oracle.

workspace A workspace is a system directory where GIS data may be stored (and formatted to contain at a minimum an INFO subdirectory) and in which feature attribute information for any ARC/INFO geo-datasets (coverages, grids, or tins) in that system directory is managed.

layer A layer is a single coverage or group of coverages with common thematic content. If there is more than one coverage in a data layer, then all coverages must:

1) represent the same kind of data
2) have common naming convention
3) be indexed by one single coverage (see below)
4) contain identical feature types and attribute tables which use **one consistent, unique set of code values**
5) have common units, projection and datum
6) have one responsible data layer manager

index An index coverage is a special ARC/INFO polygon coverage used to divide layers into manageable geographic sub-units called **tiles** - this is required by ARC/INFO processing constraints. Each polygon in the index coverage has the same geographic extent as a single tile in the set of coverages being indexed. The whole index coverage has the extent of the entire set of coverages which make up the data layer. Every polygon of the index coverage has a unique code which may be used in the naming convention for the directories in which individual coverages are stored. Many layers may be indexed by a single coverage.

relate A relationship between tables, more commonly known as a **join,** which is based on a common field. The parameters of such a relationship are stored in an ARC/INFO relate file.

Layer/Coverage/Table Documentation

MassGIS has developed a standard documentation progam (coverdoc.AML) to produce metadata for datalayers, coverages, or INFO tables. The result of the program is a documentation file or ".doc" file for each datalayer, coverage, or INFO table. The .doc file will be associated with the layer, coverage or table by having the same root name with the .doc extension. For example, if the layer code (see explanation below) is "LUS", then this file will be "LUS.DOC." When dealing with a single coverage rather than a layer, then the file will include the covername as the root - for example, "QUADS.DOC" will be the documentation file for the coverage "QUADS." When dealing with a stand-alone INFO file, not linked to a coverage, then the file will reference the name of the INFO table, with the period changed to an underscore if the INFO file has an extension. For example, if the INFO table is "CENSUS.LUT", then the documentation file will be "CENSUS_LUT.DOC." The format of the **layer/cover/table documentation** is decribed below. Because MassGIS stores data in librarian format, the explanation below describes only layers. Other users may run this program to document layers, coverages, or tables. The item names in the .doc file will remain the same (see below), however they will describe the structure of the data, be it a coverage or a table, so simply substitue the word "coverage" or "table" for "layer" in the following descriptions. The list below describes the items found in the .doc file:

LY_CODE **Layer Code:** The layer code is the abbreviated code for the layer which is used for all the individual coverage "tiles" in that layer, which are stored in the ARC/INFO Librarian data structure. For example, the hydrography derived from the USGS 25k scale topo sheets has a layer code of "hd." The coverage for quad number 135 will be stored in a directory for that tile. On export, the file will be named "hd135.e00" so that it can be

referenced as a single coverage by the end-user outside of EOEA. In order to accommodate the 8 character limitations of the DOS file-naming convention, the layer/coverage codes should typically be limited to 5 characters which will allow for 3 index id characters in the export file. If the code and index are both alpha, then there should be an underscore between them.

LY_NAME	**Layer Name**: the full name of the data layer or individual coverage. For example, "25k scale hydrography" or "soils" or "land use."
LY_PRODST	**Layer Production Status:** Code for the status of the layer or coverage (D = under development, P = final production status).
LY_SRC	**Layer Source:** General description of the source, although in most cases more detailed information should be entered into **feature source** (.fsc) table.LY_PRJ
	Layer Projection: The projection for the layer/cover (also entered in .fsc table, entered here for easy reference.)
LY_AUTO	**Layer Automation:** General description of the automation method.
LY_KEYWDS	**Layer Keywords:** should include all commonly used terms associated with the layer or cover - synonyms or related descriptive words which might be used in a keyword search for the data by anyone who was not familiar with its exact nomenclature.
LY_DESC1	**Layer Description 1:** The description of the layer or cover - a short, textual description of the data set, including some reference to the source(s), the processing methodology and other information which might help the casual user decide whether or not the data are appropriate to her use.
LY_DESC2	**Layer Description 2:** Additional room for the layer or cover description.
LY_REPMODL	**Layer Representation Model:** a description of the type of features mapped, whether raster or vector for digital data, or hardcopy for non-digital data. For raster data sets, the cell size will be recorded here, e.g. ".5 meter cell." For vector data, possible choices might include "line," "network," "point," or "area."
LY_USE	**Layer Use:** a description of the intended use of the layer/cover which will provide a general characterization of the accuracy and reliability of the data. However, more complete information about currency, accuracy and completeness of the data will be found at the coverage level.
LY_UNITS	**Layer Units:** The map units for all coverages in the data layer or for the cover.
LY_PROG1	**Layer Program 1:** The name of the program which is currently managing the data set particularly if there is a commitment to updating it.
LY_PROG2	**Layer Program 2:** The name of other programs is currently co-managing the data set if developed by multiple programs, particularly if there is a commitment to updating it.
LY_MGR	**Layer Manager:** the individual who is most directly responsible for managing the data layer/cover and most familiar with it.
LY_AGENCY	**Layer Agency:** the agency that is the official manager of the data set, and responsible for its contents.
LY_DISTMGR	**Layer Distribution Manager:** the program that is responsible for distributing the data. This is NOT necessarily the same as the layer agency.
LY_PREC	**Layer Coordinate Precision:** a choice of either single (8 significant figures) or double (15 significant figures).
LY_DISTST	**Layer Distribution Status:** restrictions on distribution. For MassGIS or other Massachusetts state agency data restrictions will be limited to legally sanctioned exemptions under FOI but may be applied to other data supplied by outside agencies or private concerns.
LY_EXPTFEE	**Layer Export Fee:** Obsolete. Data no longer sold by layer.
LY_INDXCOV	**Layer Index Coverage:** the full pathname of the index coverage.
LY_COMM1	**Layer Comments 1:** This is a memo field for any additional information that may be pertinent to use of the data.
LY_COMM2	**Layer Comments 2:** Additional room for information that may be pertinent to use of the data.
LY_COMM3	**Layer Comments 3:** Additional room for information that may be pertinent to use of the data.

LAST_MOD **Last Modification Date:** This records the date of the meta-data (not the date that the data were modified, but the date that the meta-data entry itself was last modified).

Feature Attributes, INFO tables and Related Documentation

In addition to the institutional and global "layer/cover" attributes listed above, the standard supplements the data dictionary functions built into INFO for the feature attribute and non-coverage related INFO tables, especially in a diverse, multi-user environment. This means that for each kind of feature attribute table or other INFO table the standard requires various associated files for documentation. The first is a file that defines and describes the item names. This file is an extension of the default INFO item listing. The format for this file, the **feature attribute description** table, (note that "feature" is being used to include INFO records), is as follows:

item_name	name of the item
item_desc	description of item
item_width	width of item in bytes
item_output_width	output width in bytes
item_type	data type
item_dec	number of decimal places
item_min	minimum allowable value
item_max	maximum allowable value
item_units	units of measure, if appropriate
item_update_freq	frequency of update
item_code_value	y/n flag to indicate use of code values
dict_last_mod	Records the date of the meta-data entry (not the date that the data were modified, but the date that the meta-data entry itself was last modified)

Note that the first 6 items are already stored in INFO, so this table can be populated easily.

Note that the item_name here and elsewhere can refer to an item in a related table. As mentioned above, the parameters of the relate are stored in a standard ARC/INFO table. The related item is referenced using the format **relate_name//item_name.** The format of the standard table to describe the relate is as follows:

relate_name	Name of the relate used in item_name
table-id	table to which feature attribute table is related
database	Database in which related table is stored
item_name	Item in the feature attribute table
column	Item in the related table
type	Identifies the type of index if any in related table
access	Type of security on related table

Additionally, the standard provides an explanation for the use of codes in the feature attribute tables - storing this information in related INFO tables, commonly called "lookup tables" is good practice in that it enables the display of intelligible descriptive information as labeltext for example, without excessive data storage requirements. These **feature attribute code** tables have the following format:

item_name	name of item
item_value_c	character field containing all valid values for that item when the item is of a character type.
item_value_i	integer field containing valid values for that item when the item is of an integer type.
item_value_desc	description of value
dict_last_mod	Records the date of the meta-data entry (not the date that the data were modified, but the date that the meta-data entry itself was last modified.)

The standard also documents the development and use of annotation in a geographic coverage. This is done with an **annotation** table which stores information about the various levels of annotation in an ARC/INFO coverage.

anno_level	level of annotation
anno_textset	full path of textset used to create anno
anno_symbol	symbol used to create annotation
anno_comment	comments on the creation or use of anno

Finally, the standard documents source attributes of individual features if the coverages are heterogeneous, i.e. if the features are derived from a variety of sources. (Note that this may not be appropriate or necessary - see discussion of other types of source documentation below.) Feature level source documentation is provided by the addition of a field "src" for source to the attribute table, which will contain code values referencing individual source listings for each feature type. The values of this item are described in a **feature source** table (.fsc extension) with the following format:

source_code	unique code for source
source_name	name of cover source
source_type	type of source (gps,map,cad,etc)
source_projection	projection of source material
source_scale	approx. scale of cover source
source_date	date of field conditions/publication (earlier of these if both known)
source_date_rev	source latest revision date
source_contact	contact name
src_agency	unique code for agency source
source_description	description of source
feat_resolution	minimum size of feature/pixel size
feat_comp_base	basemap onto which source was compiled
feat_comp_base_scl	compilation basemap scale
feat_horiz_accuracy	estimated horiz feature accuracy as a function of source and additional processing
feat_vert_accuracy	estimated vertical feature accuracy
dict_last_mod	Records the date of the meta-data entry (not the date that the data were modified, but the date that the meta-data entry itself was last modified.)

Just as geographic data have a source and a processing history with an associated accuracy, so do attributes need to have their source and the method by which they were determined clearly documented for users unfamiliar with the data to be able to use them effectively. To do this, all attributes have a corresponding "<item>_src" field containing source codes, which relates to a **feature attribute source** table with the following format:

item_src_code	code for attribute source
item_src	descriptive name of item source
item_src_contact	name/phone of contact if different than cover
item_src_type	type of source, such as map, photograph, CAD file, etc.
item_src_date	date of measurement, publication, or classification
item_src_agency	agency if different than cover
item_meas_meth	how attribute measured
item_accuracy	estimated attribute accuracy

Finally, as noted above, it may be appropriate to document the processing history or the source at other levels, on either a per tile or per coverage basis. When a heterogeneous datalayer is being developed on a per tile basis, there may be a different source and/or processing history for individual tiles. For example,

town tiles of zoning will have a variety of local sources, some of which may be automated by scanning, others by conversion from CAD, others by compilation. Each of these sources and methods will have associated accuracy ranges for the final GIS product. In this case, the source and accuracy information needs to be presented in relation to the index coverage for the layer/coverage and can be stored in just one file rather than with every feature attribute table. The src item gets moved to a single layerwide table, called the **feature index** table.

This table has the following fields:

tile_name	Name of the index coverage tile as stored in Librarian, eg 105 for quad no. 105
doc_code	Unique code for the documentation of this tile
source_code	Unique code for the source for this tile

The lookup tables for the above doc and source codes are the same as the documentation and source tables listed above with reference to the doc and source code items in those tables. The same structure can be duplicated for the attribute source documentation as outlined above - the “item_source” field becomes the “item_source” table with a lookup either per tile or globally.

It is often useful to know about the theoretical coincidence of coverage features with basemap features (e.g. the coincidence of open-space parcel boundaries with roads) in order to effectively maintain data through a series of basemap upgrades. This is done with a few standard codes to represent coincidence in a "cn" field added to the feature attribute table.

cn_code	code for coincidence of feature with basemap layer
cn_layer	layer name for the coincident feature type, eg. "roads"

Naming Conventions for File Types

What follows is a review of the naming conventions for the above set of files, which will ensure that the feature attribute, source and coding documentation can be extracted in an automated fashion. In all cases, the cover/layer name with a standard set of file extensions will be used to identify the meta data files. For ease of use, the file extension will be composed of two parts. The first part will specify the feature and optionally the subclass of feature. In all cases the first character will identify the **feature type.** The second part will identify the type of metadata file.

The feature types are coded as follows:

p poly or label point
n node
a arc
v grid
I info
r route (see note on subclass below for route, section and region types)
s section “
g region “

Using these codes, the metadata file types will be named as follows:

feature attribute description	<cover/layer>.<feature_type>ad
attribute code description tables	<cover/layer>.<feature_type>ac
feature source tables	<cover/layer>.<feature_type>sc
feature attribute source table	<cover/layer>.<feature_type>as
feature index source/doc table	<cover/layer>.<feature_type>xs
feature attribute relates	<cover/layer>.<feature_type>rl
feature symbolization table	<cover/layer>.<feature_type>sy
feature symbolization options table	<cover/layer>.<feautre_type>so

annotation description table	<cover/layer>.ann

Note that where a feature type has multiple subclasses or instances, as for example when there are different routesystems, <feature _type> will include the subclass name. For example, the route attribute description table for the bus subclass of the rds coverage will be given the name rds.rbusad. These standard files, and the "src" and "cn" items, will comprise the minimum standard for documentation of GIS data.

Additional File Naming Conventions

There are some guidelines for naming intermediate coverages that may also be useful. Successive coverages should be numbered as above with a <_n> after the covername. Additional qualifying information should be included in a similar fashion, such as <cover>_cl for a cleaned version, <cover>_83m for 83 meters. In general, the guideline is to have the layer or cover identifier first, then the code or qualifier second in the root file name, and standardize on the file extension. This will facilitate recognizing the origin or affiliation of the files in question.

One other standard file type whose use is recommended is a user-created table to record symbolization of features containing item names, item values, symbol numbers and specifying shadeset as well. Symbolization must be done using an AML to reselect records from this info table for the specific item and if necessary for the type of symbolization such as aggregated values, black and white, different output devices and so on. These **feature symbolization** files have the following format:

item_name	name of item to be used for symbol look-up
item_value_c	character field containing valid item values.
item_value_i	integer field containing valid item values
symbol_option	user-defined code to allow choice of symbol according to specific
symbolset	name of the symbolset to be used
symbol	symbol number
symbol_name	name of symbol, e.g. colorname
symbol_comment	comment on the symbol choice

The advantage of these files is that users unfamiliar with a given data layer can quickly use the pre-defined themes to effectively display the data.

To simplify selection of the different symbolization schemes, the options are summarized in a **feature symbolization options** file. By listing this table, the user may quickly select the desired scheme for representing features. The options file has the following format:

num_symbols	number of different symbols used in the option to represent data
symbol_option	user-defined code to allow choice of symbol according to specific mapping requirement, output device, etc.
symbolset	name of the symbolset to be used
item_name	name of item to be used for symbol look-up
desc	description of the symbol option
author	person/agency who created the symbol option
last_mod_date	date the symbol option was created or last modified